Flight Simulation (List 5)

Due: 30.11.2016

1. (a) Let $\mathcal{O}$ be a (two dimensional) rigid object, that consists of the following point masses:

mass (kg)	position (m)	speed (m/s)
1	$(3, -7)$	$(19, 3)$
2	$(0, 2)$	$(1, -3)$
3	$(1, 3)$	$(-1, -1)$
4	$(2, 4)$	$(-3, 1)$
2	$(-1, 1)$	$(3, -5)$

   What is the mass center of this object? What is the average speed? What is ω? What is the rigid speed function?

   Is there a point that is not moving? What is this point?

   (b) Assuming that $\overline{c}$ is the mass center, as obtained in (a), what is $I_{\overline{c}}$?

   (c) Now assume that on the first point mass with mass 2 kg, there works a force $(1, 1)$. At the point mass with mass 3 kg, there works a force $(-2, 1)$.

   What is the total torque (using center of mass $\overline{c}$) resulting from these forces?

   (d) What are $\overline{V}'$ (average acceleration), and ω' angular acceleration, caused by these forces?

2. Answer the questions (a),(b),(c),(d),(e) at page 417 of Mechanics of Flight, A.C.Kermode. $C_{M.LE}$ is the moment coefficient around the leading edge.

   It is a bit strange that question (b) comes before (a). It is better to make (b) first. The value $C_L^{\frac{3}{2}}/C_D$ is important for the efficiency of the air foil. A higher value means more efficiency.

   For $\alpha = 0°,\ 4°$ and $8°$, compute CP from $C_{M,LE}$, and check whether it agrees with the value given in the table.